Mathematics Toolkit: Grade 6 Objective 1.B.1.c

Standard 1.0 Knowledge of Algebra, Patterns, and Functions

Topic B. Expressions, Equations, and Inequalities

Indicator 1. Write and evaluate expressions

Objective c. Evaluate numeric expressions using the order of operations

Assessment Limits:

Use no more than 4 operations (+, -, x, ÷ with no remainders) with or without 1 set of parentheses or a division bar and whole numbers (0-100)

Table of Contents

Clarification

Mathematics Grade 6 Objective 1.B.1.c Assessment Limit 1

The order of operations is a set of rules used to determine a consistent order in which operations upon numbers are to be performed. The order of operations is:

1. Perform operations within parentheses,
2. Simplify terms with exponents,
3. Multiply and divide from left to right, and then
4. Add and subtract from left to right.

Classroom Example 1

3 + 5 - 12 ÷ 4

Answer: 3 + 5 - 12 ÷ 4
= 3 + 5 - 3
= 8 - 3
= 5

Classroom Example 2

27 - (17 - 8) ÷ 3

Answer: 27 - (17 - 8) ÷ 3
= 27 - 9 ÷ 3
= 27 - 3
= 24

Classroom Example 3

$$\frac{4\times9}{5+7}$$

Answer: $\frac{4\times 9}{5+7}=\frac{36}{12}=3$

Classroom Example 4

$$\frac{3(4\times6)}{12\div3}$$

Answer: $\frac{3(4\times6)}{12\div 3}=\frac{3\bullet 24}{12\div 3}=\frac{72}{4}=18$

Classroom Example 5

4 (3 x 2) - 2 (18 ÷ 3)

Answer: 4(3x2) - 2(18÷3)
= 4(6) - 2(6)
= 24 - 12
= 12

Sample Item #1 - Selected Response (SR) Item

Mathematics Grade 6 Objective 1.B.1.c

Note: This problem is solved without a calculator.

Look at the expression below.
12 + 4 x (12 - 9)

What is the value of the expression?

A. 24
B. 48
C. 51
D. 55

Correct Answer:
A

Sample Item #2 - Selected Response (SR) Item

Mathematics Grade 6 Objective 1.B.1.c

Look at the expression below.

36 ÷ 3 + 6 x 2

What is the value of the expression?

A. 2
B. 8
C. 24
D. 36

Correct Answer:
C

Answer Annotation

A. 2 (3 + 6 = 9, 9 x 2 = 18, 36 ÷ 18 = 2)
B. 8 (3 + 6 = 9, 36 ÷ 9 = 4, 4 x 2 = 8)
C. 24 (correct answer)
D. 36 (36 ÷ 3 = 12, 12 + 6 = 18, 18 x 2 = 36)

Sample Item #3 - Selected Response (SR) Item

Mathematics Grade 6 Objective 1.B.1.c

Look at the expression below. Which expression has a value of 24?

A. 6 + 2 x 3
B. 2 x 3 + 6 x 2
C. 4 (2 + 4)
D. 3 (7 + 3)

Correct Answer:
C

Answer Annotation

A. 6 + 2 x 3 (to get 24, add before multiplying, working left to right)
B. 2 x 3 + 6 x 2 (to get 24, would work left to right)
C. 4 (2 + 4) (correct answer)
D. 3 (7 + 3) (to get 24, did not distribute the factor of 3 to the 3)

Sample Item #4 - Brief Constructed Response (BCR) Item

Mathematics Grade 6 Objective 1.B.1.c

Look at the expression below.

90 - 48 ÷ 6 + 2

Step A

What is the value of this expression?

Step B

Explain why the value you determined is correct. Use what you know about order of operations in your explanation. Use words, numbers, and/or symbols in your explanation.

Answer Annotation

Step A Answer: 84

Step B Sample Correct Response:

To evaluate this expression, I first had to divide 48 by 6 to get 8 because in order of operations, division must happen before addition and subtraction. I then subtracted 8 from 90 to get 82 because the subtraction symbol came before the addition symbol. Finally, I added 82 and 2 to get 84.

Step B Sample Correct Response:

90 - 48 ÷ 6 + 2
= 90 - 8 + 2
= 82 + 2
= 84

Rubric - Brief Constructed Response (BCR)

Score 2
The response demonstrates a complete understanding and analysis of a problem.

- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem is clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics are clear.
- Supportive information and/or numbers are provided as appropriate. [3]

Score 1
The response demonstrates a minimal understanding and analysis of a problem.

- Partial application of a strategy in the context of the problem is indicated.
- Explanation[1] of and/or justification[2] for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate.[3]

Score 0
The response is completely incorrect, irrelevant to the problem, or missing.[4]

Notes:

[1] Explanation refers to students' ability to communicate how they arrived at the solution for an item using the language of mathematics.

[2] Justification refers to students' ability to support the reasoning used to solve a problem, or to demonstrate why the solution is correct using mathematical concepts and principles.

[3] Students need to complete rubric criteria for *explanation, justification, connections* and/or *extensions* as cued for in a given problem.

[4] Merely an exact copy or paraphrase of the problem will receive a score of "0".

Rubric Document Date: August 2003